

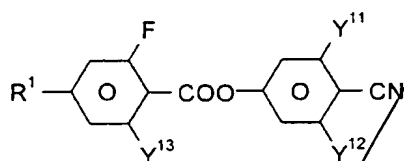
Patent Claims

Sup
A.1
5

1. An electro-optical liquid-crystal display comprising a realignment layer, for realigning liquid crystals, and a liquid-crystalline medium of positive dielectric anisotropy,

wherein said medium comprises one or more compounds of formula I

10



wherein

15

R¹ is H, alkyl having 1 to 7 carbon atoms, alkoxy having 1 to 7 carbon atoms, alkenyl having 2 to 7 carbon atoms, alkenyloxy having 2 to 7 carbon atoms or alkoxyalkyl having 2 to 7 carbon atoms, and

20

Y¹¹, Y¹² and Y¹³ are each, independently of one another, H or F; and

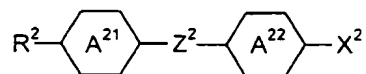
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wherein when an electric voltage is applied to said display an electric field is generated which has a component parallel to the liquid-crystal layer for realignment of the liquid crystals.

30

Sup
B.2

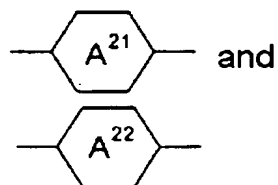
2. A liquid-crystal display according to Claim 1, wherein said medium comprises one or more compounds of formula II.



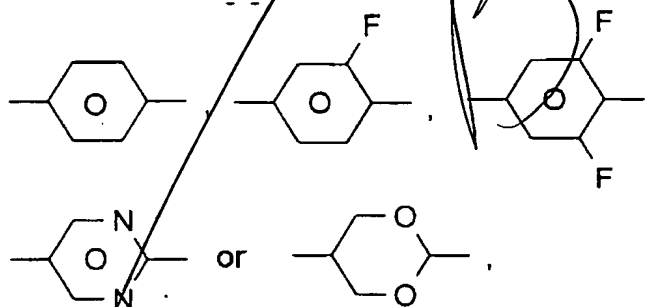
II

wherein

5 R^2 is alkyl having 1 to 7 carbon atoms,
alkoxy having 1 to 7 carbon atoms,
alkenyl having 2 to 7 carbon atoms,
alkenyloxy having 2 to 7 carbon atoms
10 or alkoxyalkyl having 2 to 7 carbon atoms,

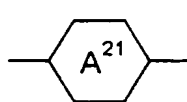


are each, independently of one another,

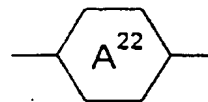


and

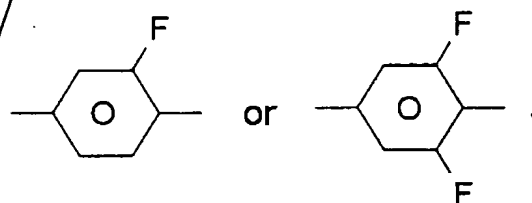
at least one of



and



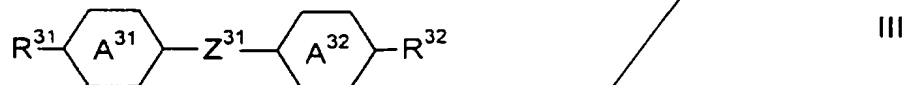
is



20 X^2 is F, Cl or CN; and

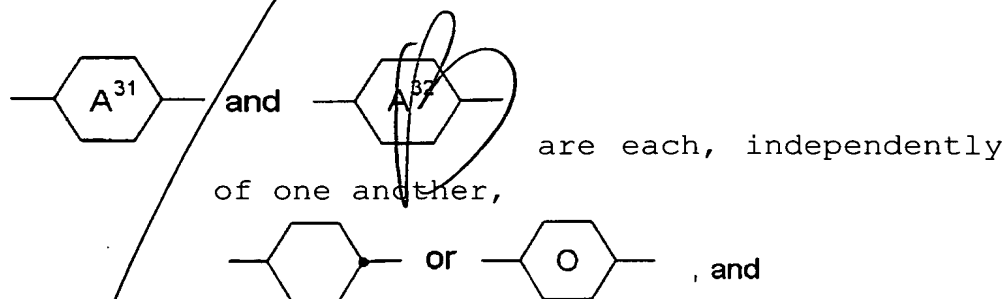
Z^2 is $-CH_2CH_2-$, $-COO-$, $-CF_2O-$ or a single bond.

- 5 3. A liquid-crystal display according Claim 1, wherein said medium comprises at least one compound of formula III



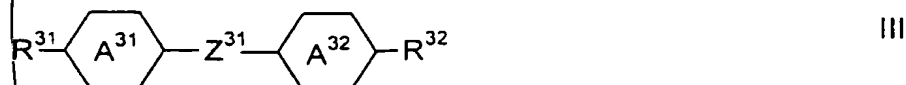
10 wherein

R^{31} and R^{32} are each, independently of one another, alkyl having 1 to 7 carbon atoms, alkoxy having 1 to 7 carbon atoms, alkenyl having 2 to 7 carbon atoms, alkenyloxy having 2 to 7 carbon atoms or alkoxyalkyl having 2 to 7 carbon atoms,



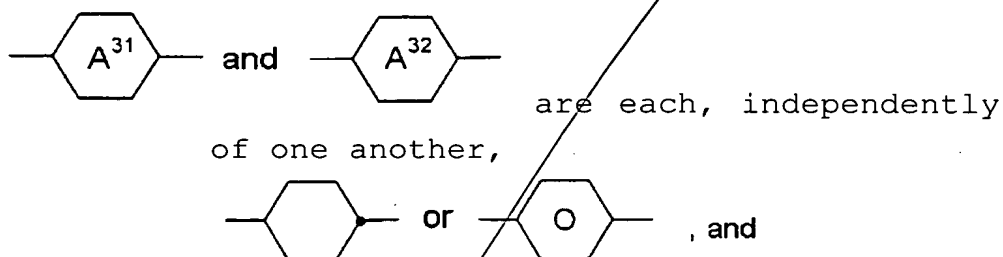
25 Z^{31} is $-CH=CH-$, $-COO-$, $-CH_2CH_2-$ or a single bond.

4. A liquid-crystal display according Claim 2, wherein said medium comprises at least one compound of formula III



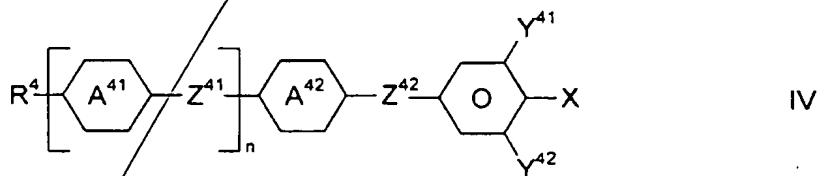
wherein

R^{31} and R^{32} are each, independently of one another,
alkyl having 1 to 7 carbon atoms,
alkoxy having 1 to 7 carbon atoms,
alkenyl having 2 to 7 carbon atoms,
alkenyloxy having 2 to 7 carbon atoms
or alkoxyalkyl having 2 to 7 carbon
atoms,



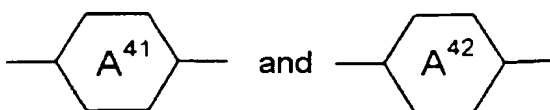
Z^{31} is $-\text{CH}=\text{CH}-$, $-\text{COO}-$, $-\text{CH}_2\text{CH}_2-$ or a single
bond.

5. A liquid-crystal display according Claim 1,
wherein said medium comprises at least one
compound of formula IV

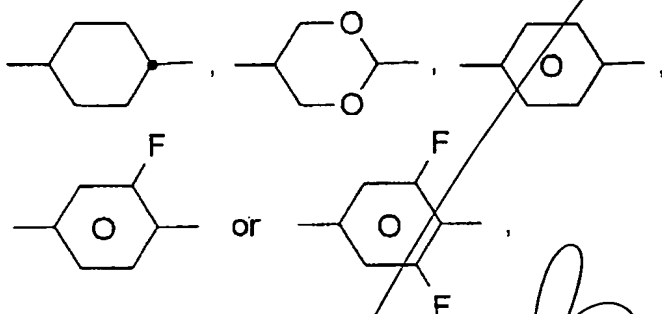


wherein

R^4 is alkyl having 1 to 7 carbon atoms,
alkoxy having 1 to 7 carbon atoms,
alkenyl having 2 to 7 carbon atoms,
alkenyloxy having 2 to 7 carbon atoms
or alkoxyalkyl having 2 to 7 carbon
atoms,



5 are each,
 independently of one another,



10 ,
 Z^{41} and Z^{42} are each, independently of one another,
 -CF₂O-, -COO-, -CH₂CH₂- or a single
 bond,

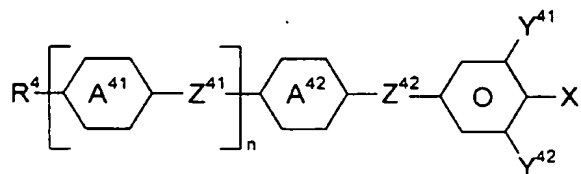
15 n is 0 or 1,

 X is OCF₃, OCF₂H or F,

20 and

Y^{41} and Y^{42} are each, independently of one another,
 H or F.

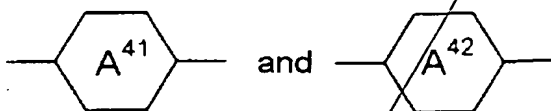
25 6. A liquid-crystal display according Claim 2,
 wherein said medium comprises at least one
 compound of formula IV



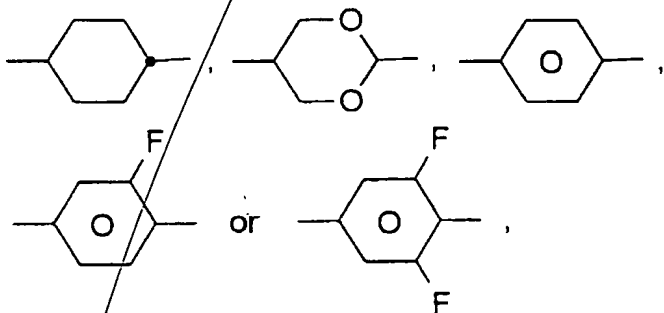
IV

wherein

5 R^4 is alkyl having 1 to 7 carbon atoms,
alkoxy having 1 to 7 carbon atoms,
alkenyl having 2 to 7 carbon atoms,
alkenyloxy having 2 to 7 carbon atoms
10 or alkoxyalkyl having 2 to 7 carbon
atoms,



15 are each,
independently of one another,



20 Z^{41} and Z^{42} are each, independently of one another,
-CF₂O-, -COO-, -CH₂CH₂- or a single
bond,

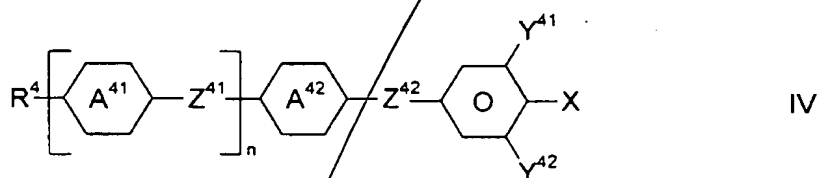
25 n is 0 or 1,

X is OCF_3 , OCF_2H or F,

and

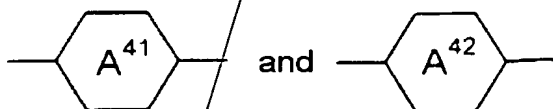
Y^{41} and Y^{42} are each, independently of one another, H or F.

7. A liquid-crystal display according Claim 3, wherein said medium comprises at least one compound of formula IV

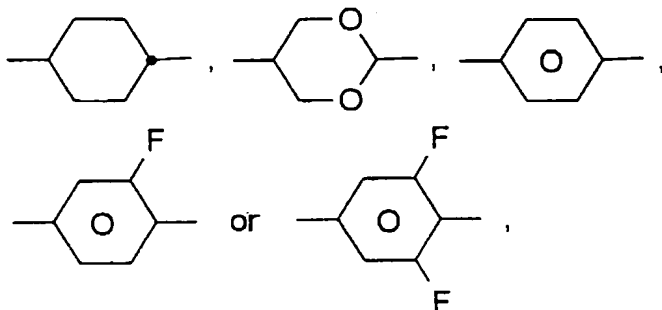


wherein

R^4 is alkyl having 1 to 7 carbon atoms, alkoxy having 1 to 7 carbon atoms, alkenyl having 2 to 7 carbon atoms, alkenyloxy having 2 to 7 carbon atoms or alkoxyalkyl having 2 to 7 carbon atoms,



are each, independently of one another,



Z^{41} and Z^{42} are each, independently of one another,
 $-\text{CF}_2\text{O}-$, $-\text{COO}-$, $-\text{CH}_2\text{CH}_2-$ or a single
bond,

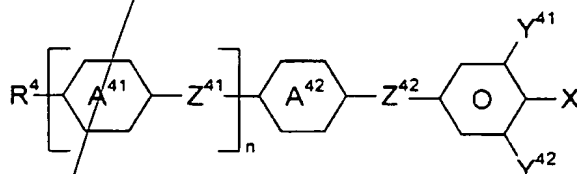
n is 0 or 1,

X is OCF_3 , OCF_2H or F ,

and

Y^{41} and Y^{42} are each, independently of one another,
 H or F .

8. A liquid-crystal display according Claim 4,
wherein said medium comprises at least one
compound of formula IV

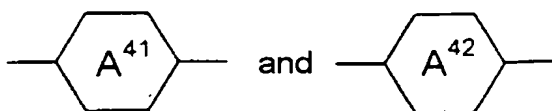


IV

wherein

R^4 is alkyl having 1 to 7 carbon atoms,
alkoxy having 1 to 7 carbon atoms,
alkenyl having 2 to 7 carbon atoms,
alkenyloxy having 2 to 7 carbon atoms

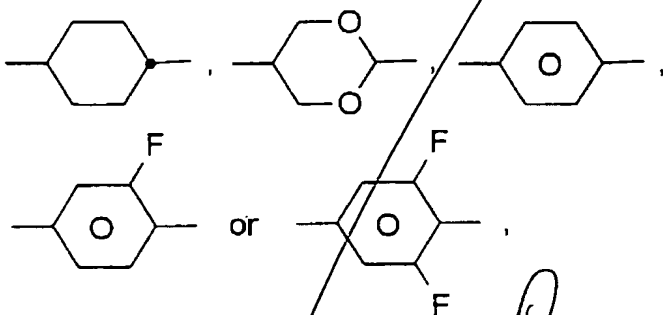
or alkoxyalkyl having 2 to 7 carbon atoms,



5

are each,
independently of one another,

10



15

Z^{41} and Z^{42} are each, independently of one another,
-CF₂O-, -COO-, -CH₂CH₂- or a single bond,

n is 0 or 1,

20

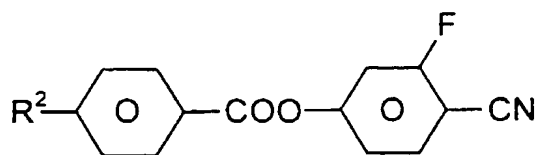
X is OCF₃, OCF₂H or F,

and

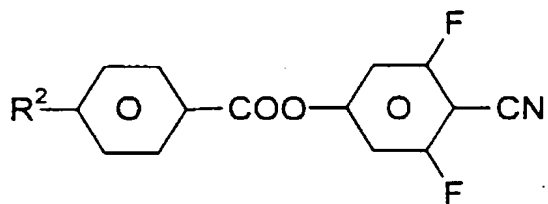
25

Y^{41} and Y^{42} are each, independently of one another,
H or F.

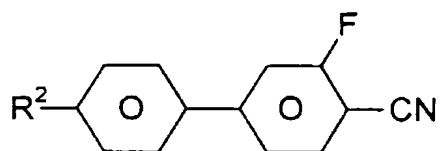
9. A liquid-crystal display according to Claim 2,
wherein medium comprises one or more compounds of
formulae IIa to IIg



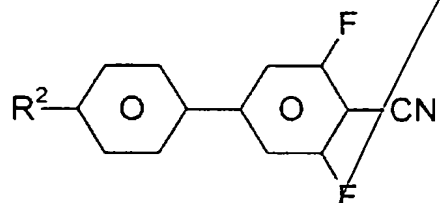
IIa



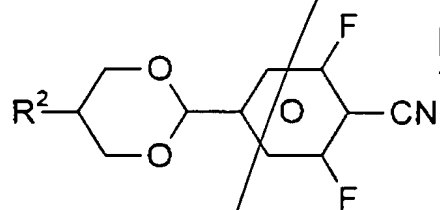
IIb



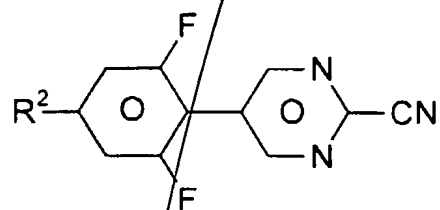
IIc



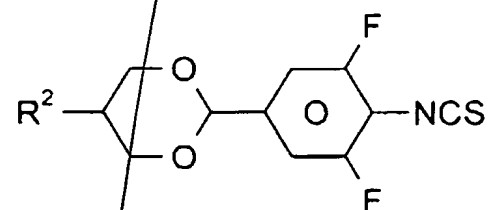
IId



IIf

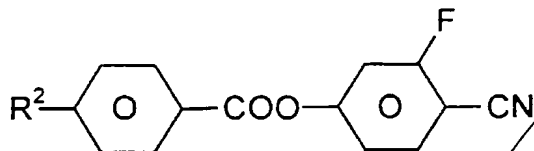


IIg



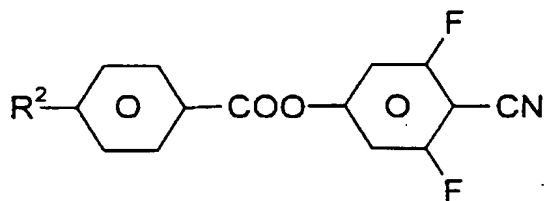
IIg

- 5

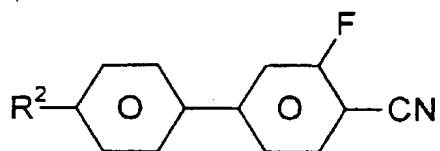


11a

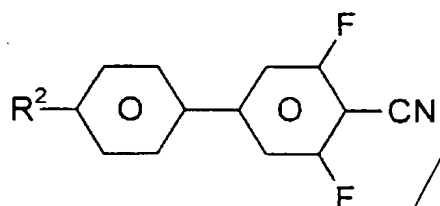




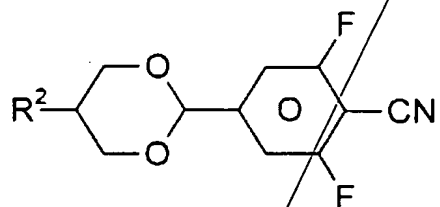
IIb



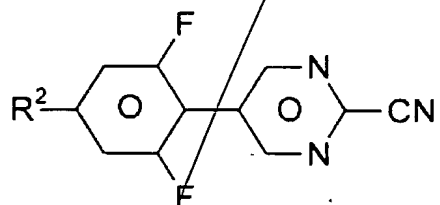
IIc



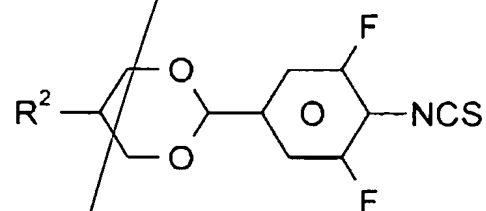
IIId



IIe

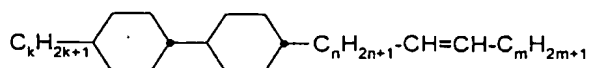


IIIf

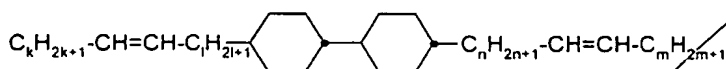


IIg

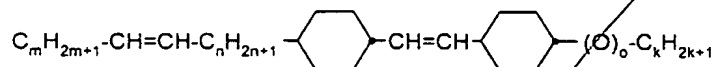
- 5 11. A liquid-crystal display according Claim 3, wherein said medium comprises one or more compounds of formulae IIIa to IIIc



IIIa



IIIb



IIIc

wherein

5

k is 1, 2, 3, 4 or 5,

m and n are each 0, 1, 2 or 3,

10

m + n is ≤ 5, and

o is 0 or 1.

12. A liquid-crystal display according to Claim 8,
wherein said medium comprises

15

- 1 to 35% of one or more compounds of the
formula I,

20

- 3 to 30% of one or more compounds of the
formula II,

- 3 to 45% of one or more compounds of the
formula III,

25

and

- 5 to 60% by weight of at least one compound of
the formula IV.

30

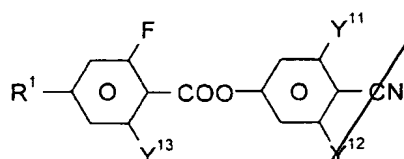
13. A liquid-crystal display according to Claim 1, wherein pixels of the display are addressed by means of an active matrix.

5
Sub
A2

14. A liquid-crystalline medium of positive dielectric anisotropy comprising at least two liquid-crystal compounds

wherein at least one of said compounds is of formula I

10



wherein

15

R¹ is H, alkyl having 1 to 7 carbon atoms, alkoxy having 1 to 7 carbon atoms, alkenyl having 2 to 7 carbon atoms, alkenyloxy having 2 to 7 carbon atoms or alkoxyalkyl having 2 to 7 carbon atoms, and

20

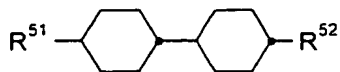
Y¹¹, Y¹² and Y¹³ are each, independently of one another, H or F.

25

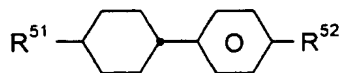
15. In a method of generating an electro-optical effect using a liquid-crystal display, the improvement wherein a display according to claim 1 is used to generate said effect.

30

16. A liquid-crystal display according to claim 1, wherein said medium additionally comprises one or more compounds of formulae Va and Vb



Va

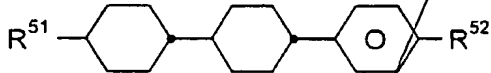


Vb

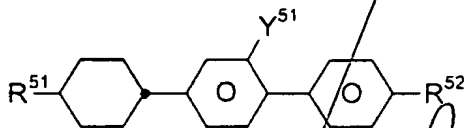
in which R^{51} and R^{52} are each, independently of one another, alkyl or alkoxy having 1 to 7 carbon atoms or alkenyl, alkenyloxy or alkoxyalkyl having 2 to 7 carbon atoms,

and/or

one or more compounds of formulae Vc and Vd



Vc



Vd

in which

R^{51} and R^{52} independently of one another, are as defined above, and Y^{51} is H or F.

17. A liquid-crystal display according to Claim 8, wherein said medium comprises

- 2 to 30% of one or more compounds of the formula I,
- 5 to 25% of one or more compounds of the formula II,
- 5 to 40% of one or more compounds of the formula III,

and

5 - 5 to 50% by weight of at least one compound of
 the formula IV.

18. A liquid crystal display according to claim 1,
 wherein said medium has a birefringence of <0.12 ,
 a flow viscosity at 20° of $<30 \text{ mm}^2 \cdot \text{s}^{-1}$, a
10 resistivity at 20°C of 5×10^{10} to $5 \times 10^{13} \Omega \cdot \text{cm}$,
 a rotational viscosity at 20°C of $<130 \text{ mPa} \cdot \text{s}$, and
 a clearing point above 60°C .

19. A liquid-crystal display according to claim 1,
15 wherein said medium has a birefringence of 0.05 -
 0.11 .

20. A liquid-crystal display according to claim 1,
 wherein said medium has a flow viscosity at 20°C of
20 15 - $25 \text{ mm}^2 \cdot \text{s}^{-1}$.

21. A liquid-crystal display according to claim 1,
 wherein said medium has a resistivity at 20°C of 5
 $\times 10^{11}$ to $5 \times 10^{12} \Omega \cdot \text{cm}$.

22. A liquid-crystal display according to claim 1,
 wherein said medium has a rotational viscosity at
25 20°C of 70 - $110 \text{ mPa} \cdot \text{s}$.

30 23. A liquid-crystal display according to claim 1,
 wherein said medium exhibits a storage stability
 of at least 1000 hours at -30°C .

Add
C2 A3